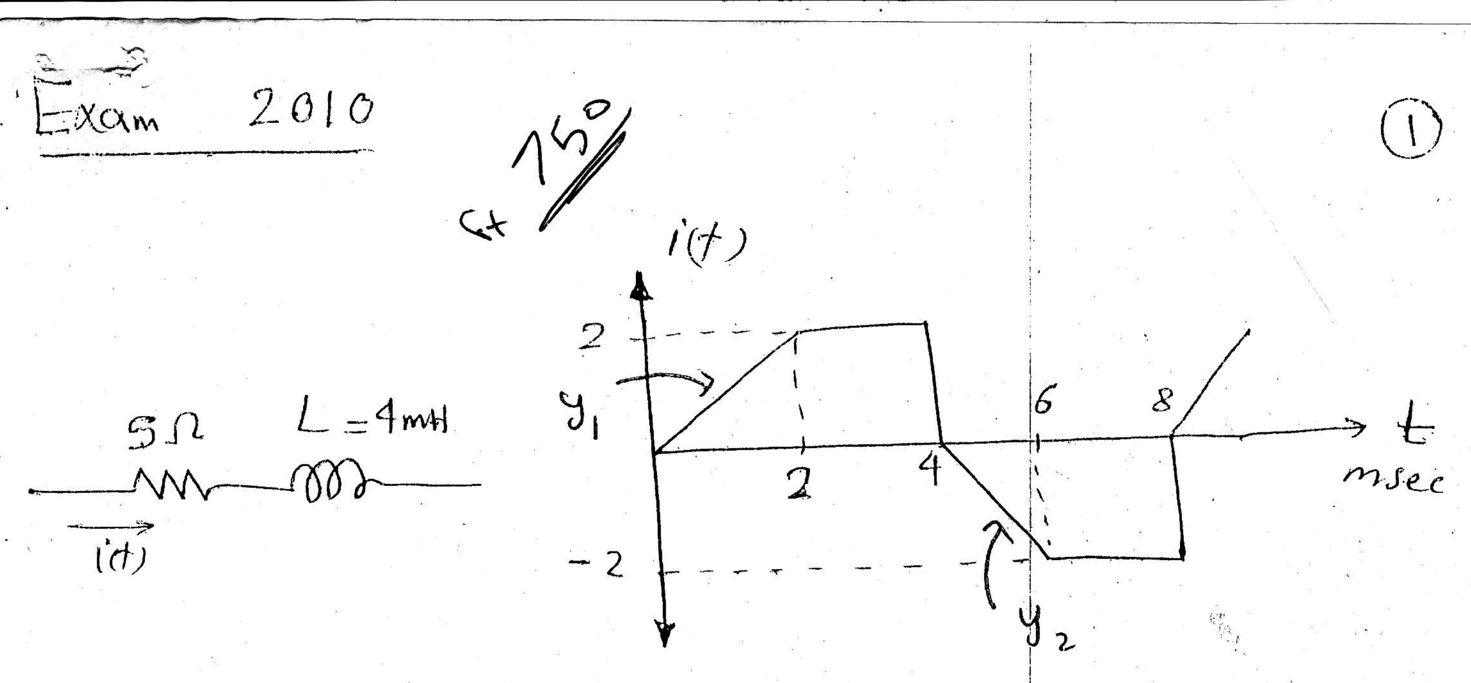


find $v_R(t)$, $v_L(t)$, V_{total}

$$i(t) = \begin{cases} t & 0 \le t \le 2 \\ 2 & 2 \le t \le 4 \\ -t+4 & 4 \le t \le 6 \\ -2 & 6 \le t \le 8 \end{cases}$$

$y_1 = t + C_1$

$y_1(0) = 0 \rightarrow C_1 = 0$

$y_2' = -t + C_2$

$y_2(4) = 0 = -4 + C_2$

$\therefore C_2 = 4$

$V_R(t) = I(t) * R$

$$v_R(t) = \begin{cases} 5t & 0 \le t \le 2 \\ 10 & 2 \le t \le 4 \\ -5t+20 & 4 \le t \le 6 \\ -10 & 6 \le t \le 8 \end{cases}$$

$$V_L(t) = L \frac{di}{dt}$$

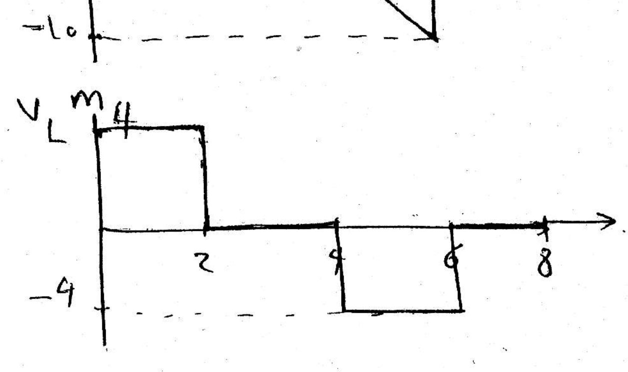
$$v_L(t) = 4\,mH * \begin{cases} 1 & 0 \le t \le 2 \\ 0 & 2 \le t \le 4 \\ -1 & 4 \le t \le 6 \\ 0 & 6 \le t \le 8 \end{cases}$$

$$v_L(t) \begin{cases} 4m & 0 \le t \le 2 \\ 0 & 2 \le t \le 4 \\ -4m & 4 \le t \le 6 \\ 0 & 6 \le t \le 8 \end{cases}$$

$$v(t) = v_R + v_L \simeq V_R$$

$$v_T = \begin{cases} 5t + 4m & 0 \le t \le 2 \\ 10 & 2 \le t \le 4 \\ -5t + 20 - 4m & 4 \le t \le 6 \\ -10 & 6 \le t \le 8 \end{cases}$$

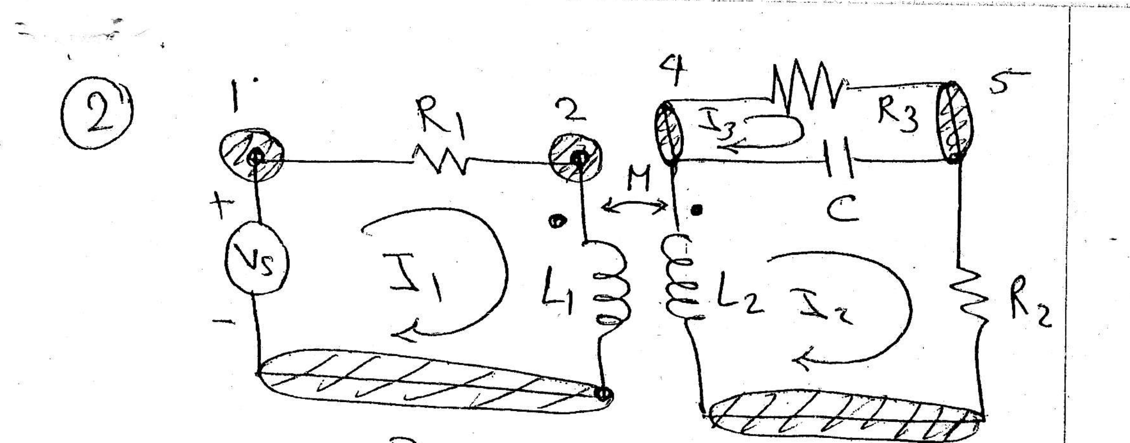
V_R

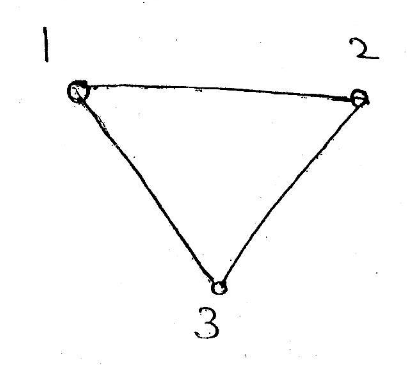


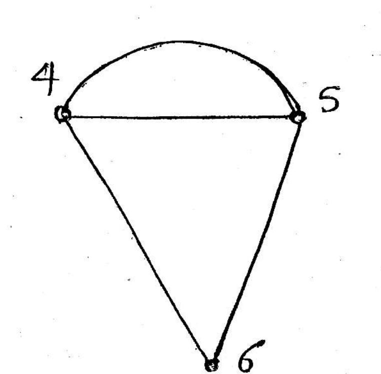
V_T

2 4 6 8 t

②







Loop 1 :-

$$V_S = I_1 R_1 + V_{L_1}$$

$$V_{L_1} = L_1 \frac{di_1}{dt} - M \frac{di_2}{dt}$$

*** K.V.L for Loop 2 :-**

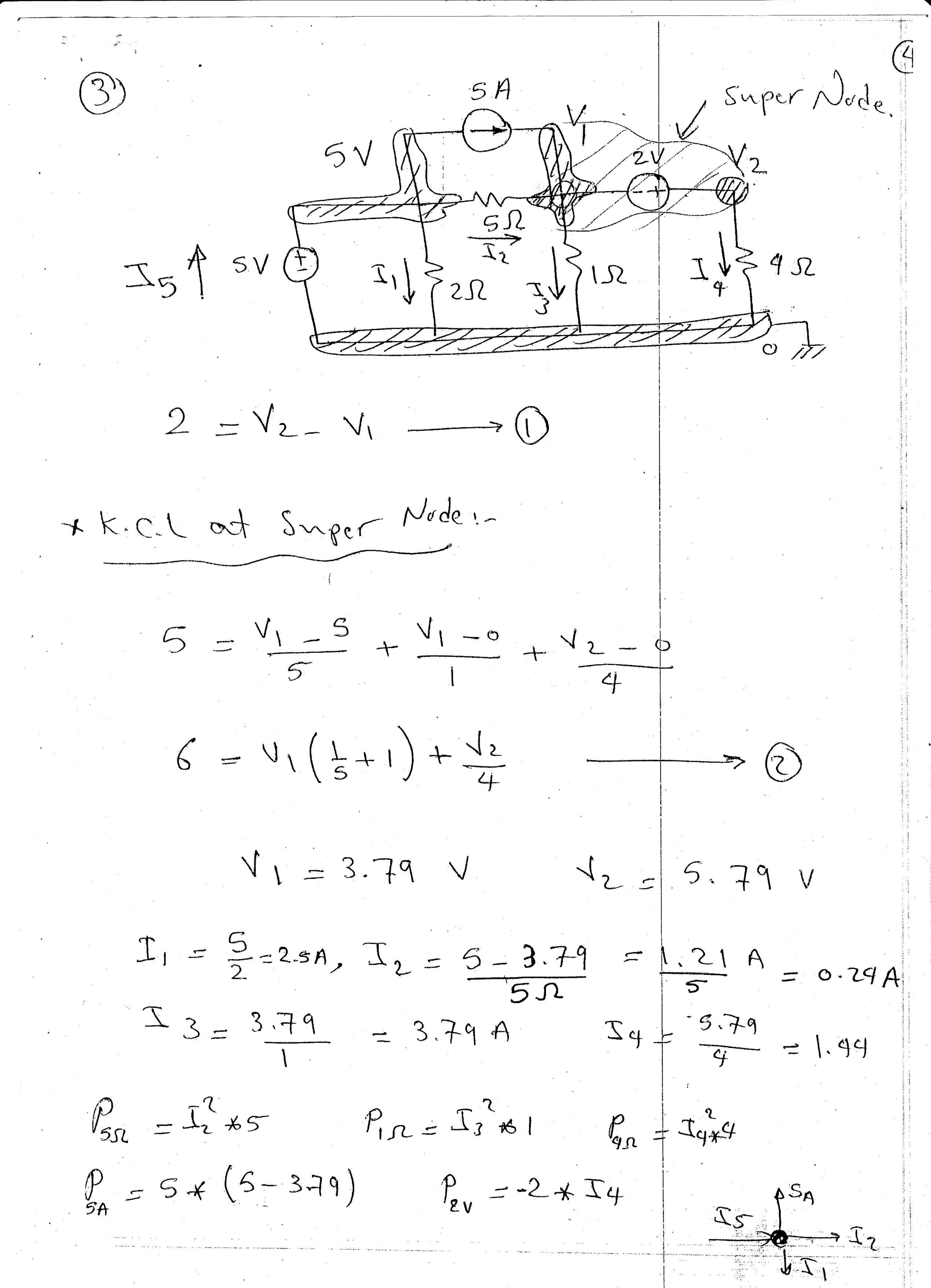
$$0 = V_{L_2} + R_2 I_2 + \frac{1}{C} \int (I_2 - I_3) dt$$

$$V_{L_2} = L_2 \frac{di_2}{dt} - M \frac{di_1}{dt}$$

K.V.L for Loop 3 :

$$0 = I_3 R_3 + \frac{1}{C} \int (I_3 - I_2) dt$$

(3)



$$2 = V_2 - V_1 \longrightarrow (1)$$

* K.C.L at Super Node :-

$$5 = \frac{V_1 - 5}{5} + \frac{V_1 - 0}{1} + \frac{V_2 - 0}{4}$$

$$6 = V_1\left(\frac{1}{5} + 1\right) + \frac{V_2}{4} \longrightarrow (2)$$

$V_1 = 3.79\ V$ $\quad V_2 = 5.79\ V$

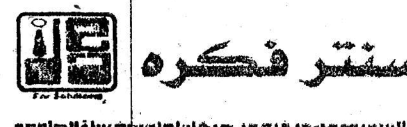
$I_1 = \frac{5}{2} = 2.5A$, $I_2 = \frac{5 - 3.79}{5\Omega} = \frac{1.21\ A}{5} = 0.24A$

$I_3 = \frac{3.79}{1} = 3.79\ A$ $\quad I_4 = \frac{5.79}{4} = 1.44$

$P_{5\Omega} = I_2^2 * 5$ $\quad P_{1\Omega} = I_3^2 * 1$ $\quad P_{4\Omega} = I_4^2 * 4$

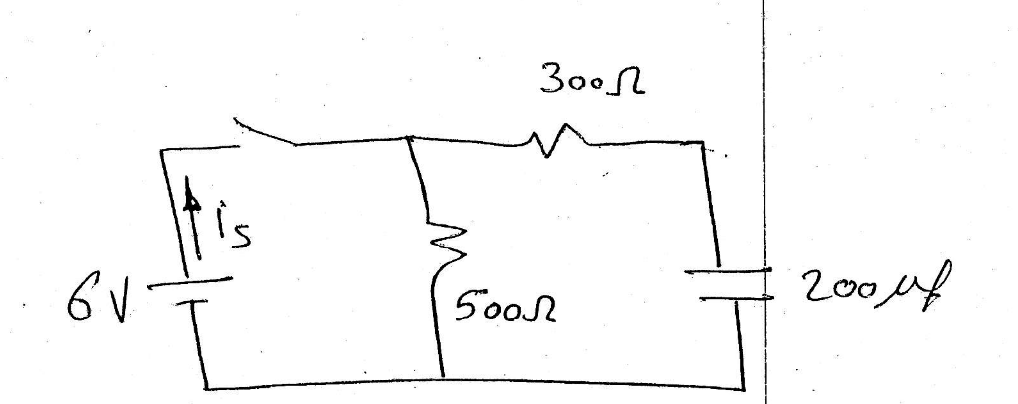
$P_{5A} = 5 * (5 - 3.79)$ $\quad P_{2V} = -2 * I_4$

$I_5 = I_1 + I_2 + 5$



$P_{5V} = -5 * I_5$





- $t < 0 \longrightarrow$ initial value

300Ω
i'_s
6
500Ω
S.C

$$i(0) = \frac{6}{300 // 500}$$

$$= \frac{6}{187.5} = 32mA$$

$$i(t) = i'_c(t) + i'_p(t)$$

$$i_c(t) = K e^{-\frac{t}{\tau}}$$

$$\tau = RC$$

$$= 300 * 200\mu f$$

$$= 60 \text{ ms}$$

$$i_c(t) = K e^{-\frac{t}{60ms}}$$

$\underline{i'_p(t)}$ $\qquad i'_p(t) = \frac{6}{500} = 12mA$

$$i(t) = i_c(t) + i_p(t)$$

$$i(t) = K e^{\frac{-t}{60ms}} + 12mA$$

$$i(0) = 32mA = K e^{0} + 12mA \rightarrow K = 20mA$$

$$\therefore i(t) = 20mA\, e^{\frac{-t}{60ms}} + 12mA$$

$$i(60ms) = 20mA\, e^{\frac{-60ms}{60ms}} + 12mA$$

$$= 19.35\ mA$$

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(5)

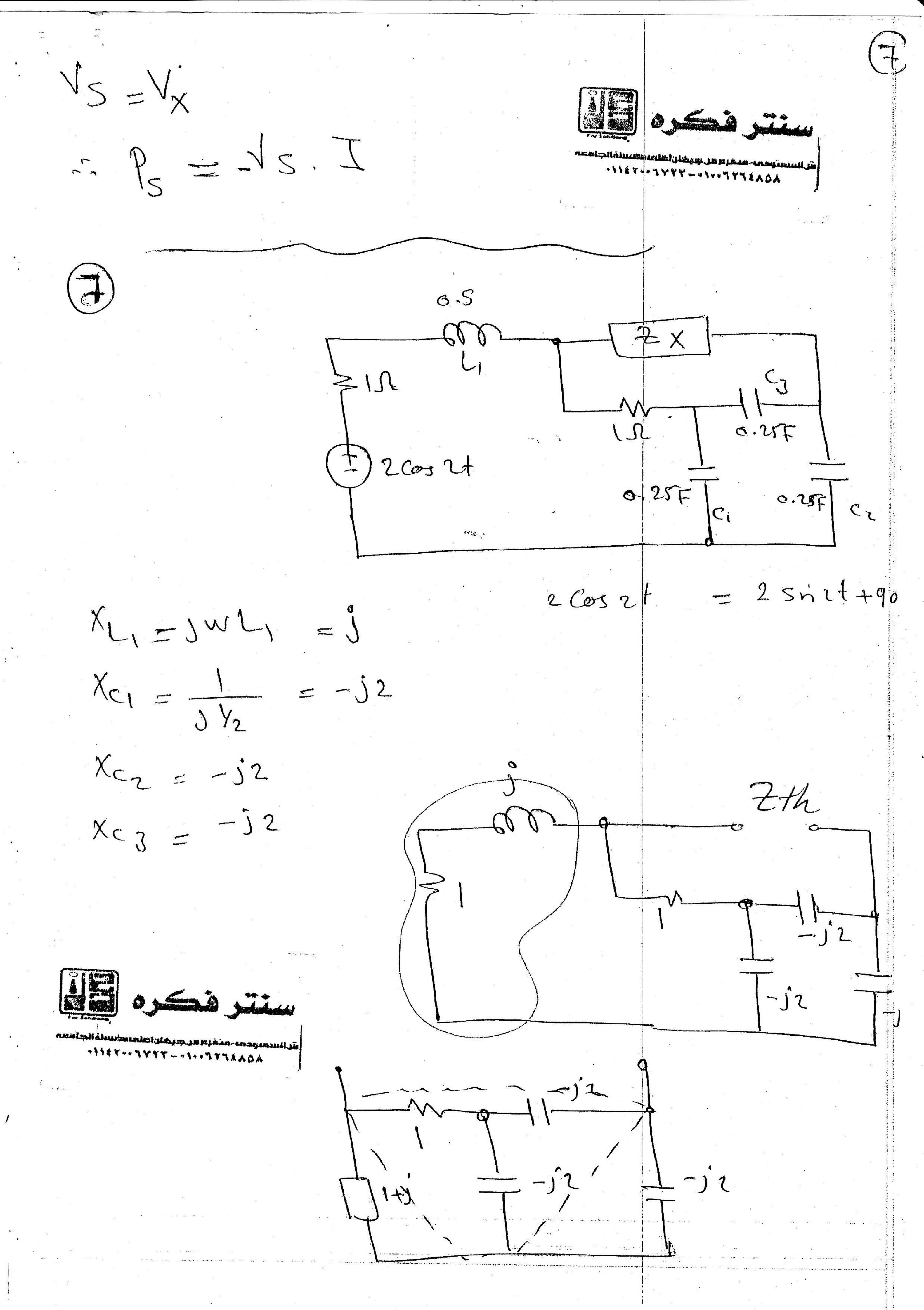
$$I_1 = \frac{V}{3} = \frac{45}{3} = 15$$

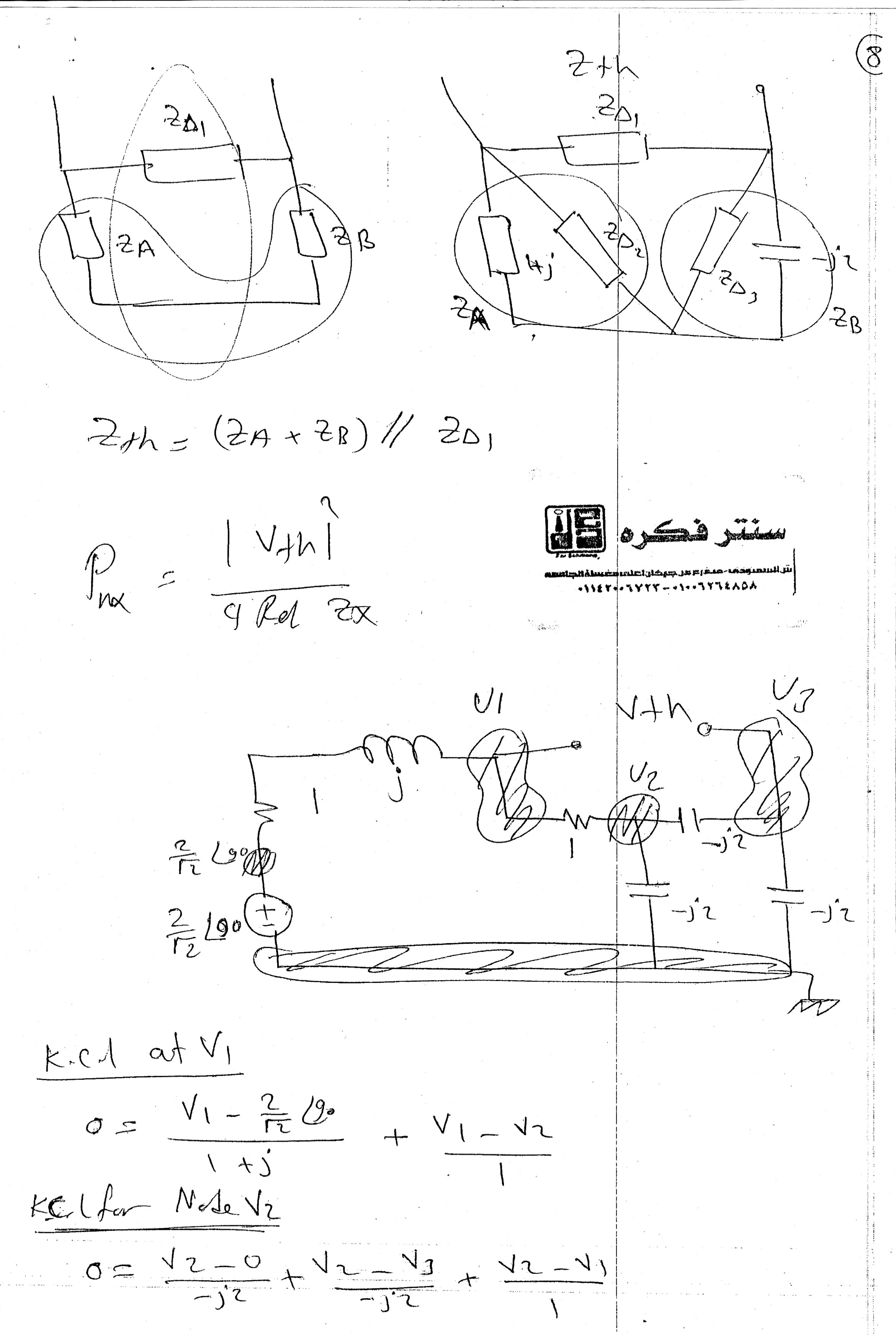
$$V_X = I_1 * (3-j3) = 15\,(3-j3)$$

$$= 45 - j\,45$$

$$I_2 = \frac{V_X}{5-j2} = \frac{45 - j45}{5-j2}$$

$$I = I_1 + I_2$$

7
Vs = Vx
∴ Ps = Vs . I
سنتر فكره
7
0.5
L1
1Ω
Zx
C3
1Ω
0.25F
2 Cos 2t
0.25F
C1
0.25F
C2
2 Cos 2t = 2 sin 2t + 90
XL1 = JWL1 = j
XC1 = 1 / J 1/2 = -j2
XC2 = -j2
XC3 = -j2
j
Zth
1
1
-j2
-j2
-j
سنتر فكره
-j2
1
1+j
-j2
-j2



$$Z_{th} = (Z_A + Z_B) \,//\, Z_{\Delta 1}$$

$$P_{max} = \frac{|V_{th}|^2}{4\, Re\, Z_X}$$

K.C.L at V_1

$$0 = \frac{V_1 - \frac{2}{\sqrt{2}}\angle 90}{1 + j} + \frac{V_1 - V_2}{1}$$

KCL for Node V_2

$$0 = \frac{V_2 - 0}{-j2} + \frac{V_2 - V_3}{-j2} + \frac{V_2 - V_1}{1}$$

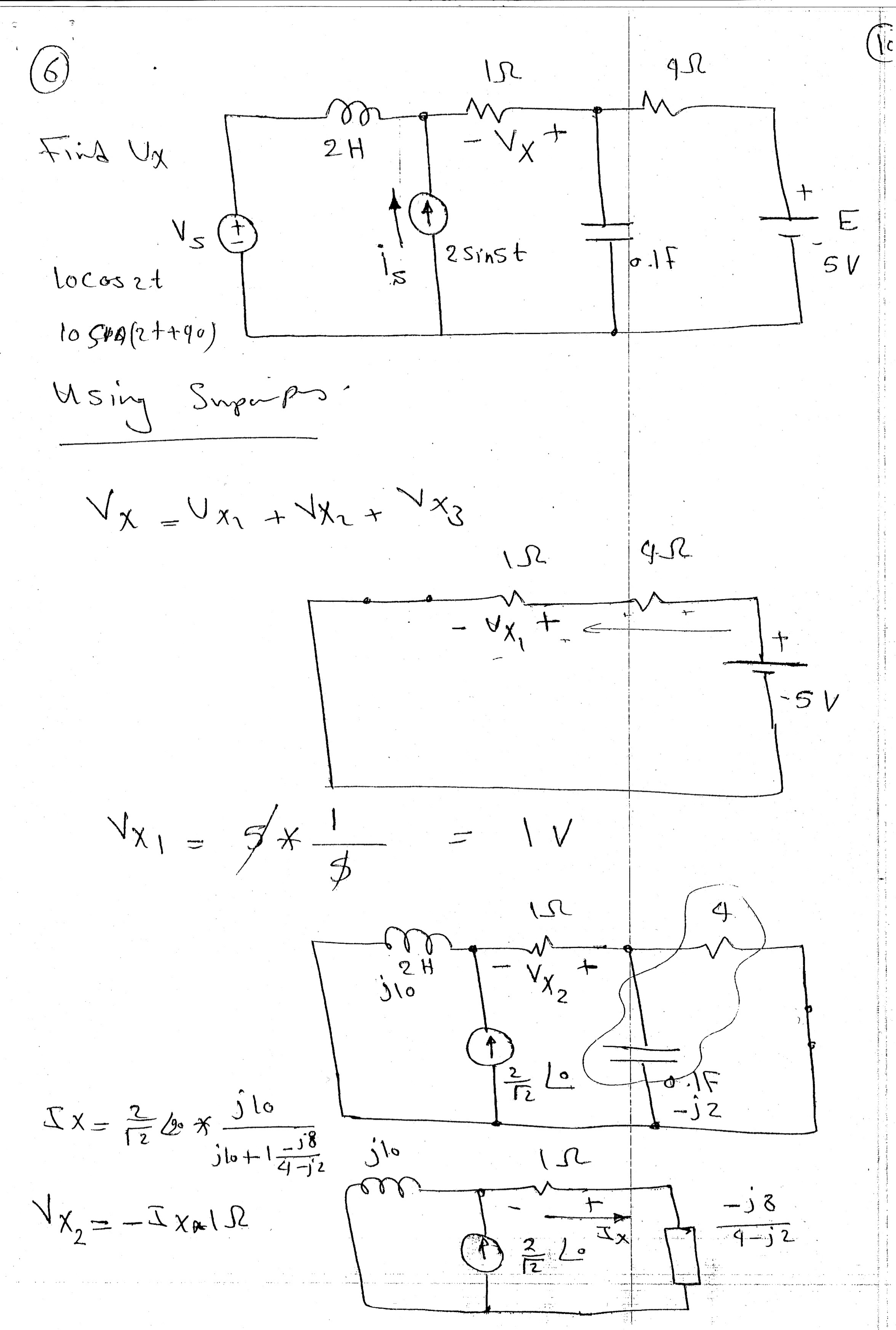
K.C.L at V_3

$$0 = \frac{V_3 - 0}{-j2} + \frac{V_3 - V_2}{-j2}$$

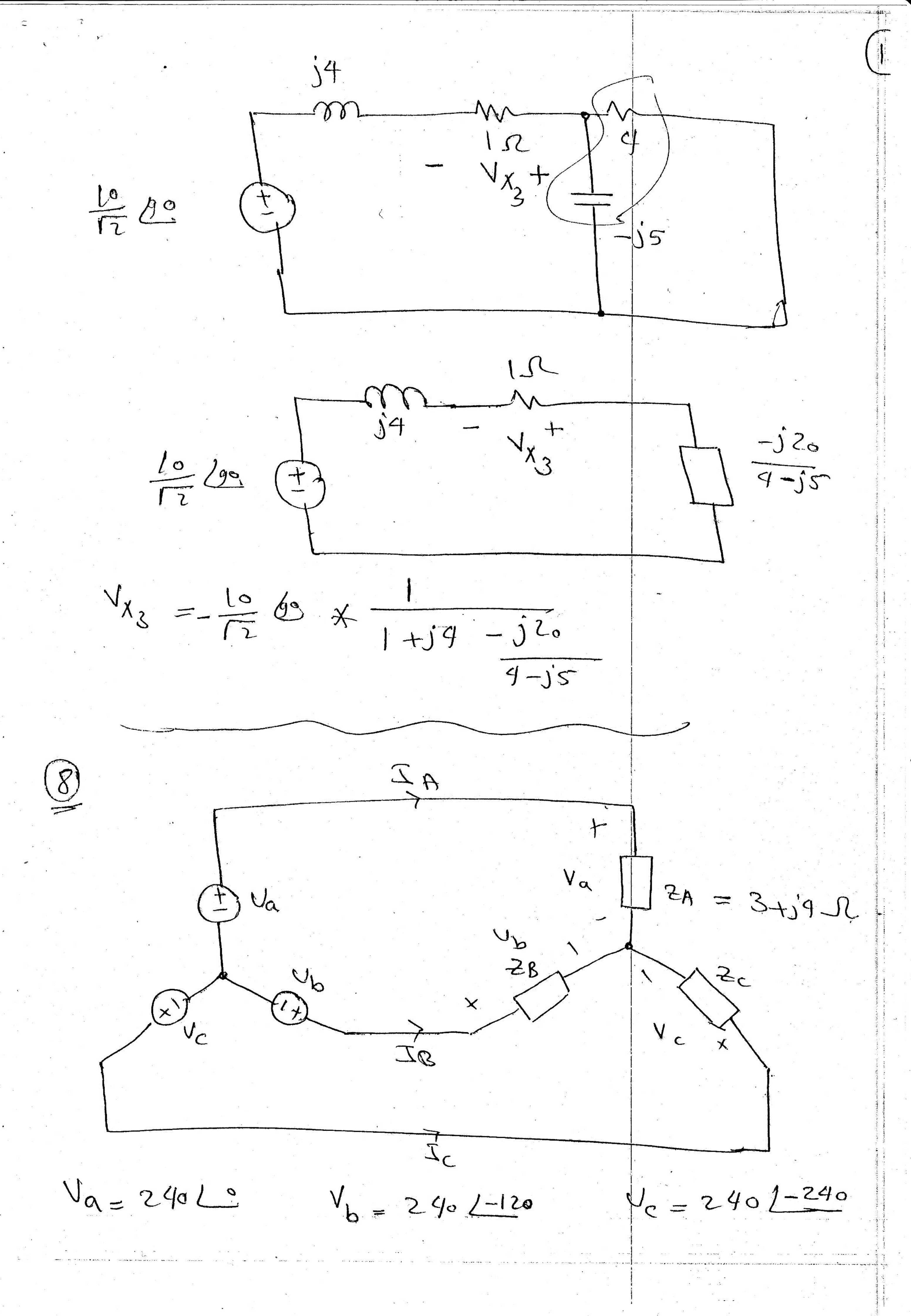
بحل المعادلات نوجد V_1, V_2, V_3

$$\therefore V_{th} = V_1 - V_3$$





10
(6)
Find Vx
2H
1Ω
4Ω
- Vx +
Vs
is
2 sin 5t
0.1F
E
5V
10 cos 2t
10 sin(2t+90)
Using Superpos.
Vx = Vx1 + Vx2 + Vx3
1Ω
4Ω
- Vx1 +
5V
Vx1 = 5 * 1/5 = 1 V
1Ω
4
2H
j10
- Vx2 +
2/√2 ∠0
0.1F
-j2
Ix = 2/√2 ∠90 * j10 / (j10 + 1 + -j8/(4-j2))
Vx2 = -Ix * 1Ω
j10
1Ω
- +
Ix
2/√2 ∠0
-j8 / 4-j2


1
j4
1 Ω
4
- Vx3 +
-j5
10/√2 ∠90
1Ω
j4
- Vx3 +
-j20 / 4-j5
10/√2 ∠90
Vx3 = - 10/√2 ∠90 * 1 / (1 + j4 - j20/(4-j5))
8
IA
Va
Va
ZA = 3+j4 Ω
Vb
ZB
Zc
Vb
Vc
Vc
IB
Ic
Va = 240∠0
Vb = 240∠-120
Vc = 240∠-240

$$I_A = I_a = \frac{240\angle 0}{3+j4} = \frac{240\angle 0}{5\angle 53.13} = 48\angle -53.13$$

$$I_B = \frac{240\angle -120}{5\angle 53.13} = 48\angle -173.13$$

$$I_C = I_c = \frac{240\angle -240}{5\angle 53.13} = 48\angle -293.13$$

$$P.f = \cos\theta_Z$$

$$P.f = 0.3$$

---

(9)

$f_o = 1kHz$

$$Y = \frac{1}{R_1 + j\omega L} + \frac{1}{R_2 + \frac{1}{j\omega C}}$$

$$Y = \frac{1}{R_1 + j\omega L}\left(\frac{R_1 - j\omega L}{R_1 - j\omega L}\right) + \frac{R_2 - \frac{1}{j\omega C}}{R_2^2 + \frac{1}{j\omega C^2}}$$

$$Y = \frac{R_1 - jwL}{R_1^2 + w^2L^2} + \frac{R_2 - \frac{1}{jwc}}{R_2^2 + \frac{1}{w^2c^2}}$$

$$= \frac{R_1}{R_1^2 + w^2L^2} - \frac{jwL}{R_1^2 + w^2L^2} + \frac{R_2}{R_2^2 + \frac{1}{w^2c^2}}$$

$$- \frac{1/jwc}{R_2^2 + \frac{1}{w^2C^2}}$$

$$Y = \left(\frac{R_1}{R_1^2 + w^2L^2} + \frac{R_2}{R_2^2 + \frac{1}{w^2C^2}} \right) - j \left(\frac{wL}{R_1^2 + w^2L^2} + \frac{1/wc}{R_2^2 + \frac{1}{w^2c}} \right.$$

$$\frac{w_o L}{R_1^2 + w_o^2 L^2} + \frac{1/w_o c}{R_2^2 + \frac{1}{w_o^2 C^2}} = 0$$

$$\therefore w_o = 2\pi f_o = 2\pi \times 1kH = \text{———}$$

L نوجد